

## **APPENDIX B.11 OHIO-WABASH LOWLANDS SERVICE AREA**

### **ELEMENT 1. SERVICE AREA DESCRIPTION**



The Ohio-Wabash Lowlands Service Area (SA) is located in the most southwestern part of Indiana and is composed of all or portions of the following three 8-digit HUC watersheds:

- 05140202 - Highland-Pigeon
- 05140201 - Lower Ohio-Little Pigeon
- 05120113 - Lower Wabash

The Ohio-Wabash Lowlands SA includes all or portions of nine Indiana counties listed below and is located within the Southern Hills and Lowlands physiographic region.

Gibson	Crawford	Warrick
Pike	Perry	Vanderburgh
Dubois	Spencer	Posey

The Ohio-Wabash Lowlands SA drains 2,101 square miles of southwestern Indiana and is located mainly in the Interior River Valleys and Hills, or Interior River Lowland ecoregion; it is bordered on three sides by the Patoka River, Wabash River, and Ohio River. Key features of this region include wide, shallow valleys with wind-blown silt deposits in the west and sandstone bedrock exposure in the east; the soils in this area are neutral to acidic. Prior to the area being cleared for agricultural use and surface mining, mesophytic and oak-hickory forests flourished (U.S. EPA: Ecoregions of Indiana).

A majority of state and federal lands within this SA are located in the easternmost portion of the SA, along its border with the Upper Ohio SA. Popular streams within this SA include Pigeon Creek, Little Pigeon Creek, and the Anderson River, all of which drain to the Ohio River.

Based on the 2011 NLCD, the land cover type with the most area in the Ohio-Wabash Lowlands SA is agricultural land use (54.9%), followed by forest and scrub/shrub (29.6%), developed and impervious land use (10.14%), and wetland and open water (4%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 1.5% per the NLCD to 4% per the NWI. Emergent herbaceous wetlands range from 0.4% per the 2011 NLCD to 0.7% per the NWI.

## ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Ohio-Wabash Lowlands SA have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

### 2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Ohio-Wabash Lowlands SA from 2009 – 2015 was collected and analyzed (**Table 108**). According to the data, 856.7 acres of impacted wetlands and 539,692 linear feet of impacted streams required mitigation in the seven year time period. Locations of the permitted stream and wetland impacts are provided in **Figure 126**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impacts per Category
Agriculture	1,175	0.22%	0	0.00%
Dam	0	0.00%	0	0.00%
Development	23,602.5	4.37%	37.905	4.42%
Energy Production	511,562	94.79%	815.663	95.21%
Transportation	3,352.5	0.62%	3.151	0.37%
Grand Total	539,692	100.00%	856.719	100.00%

Table 108. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015  
Source: USACE Louisville District

# Ohio-Wabash Lowlands Service Area

## 404 Permitted Aquatic Resource Impacts Requiring Mitigation

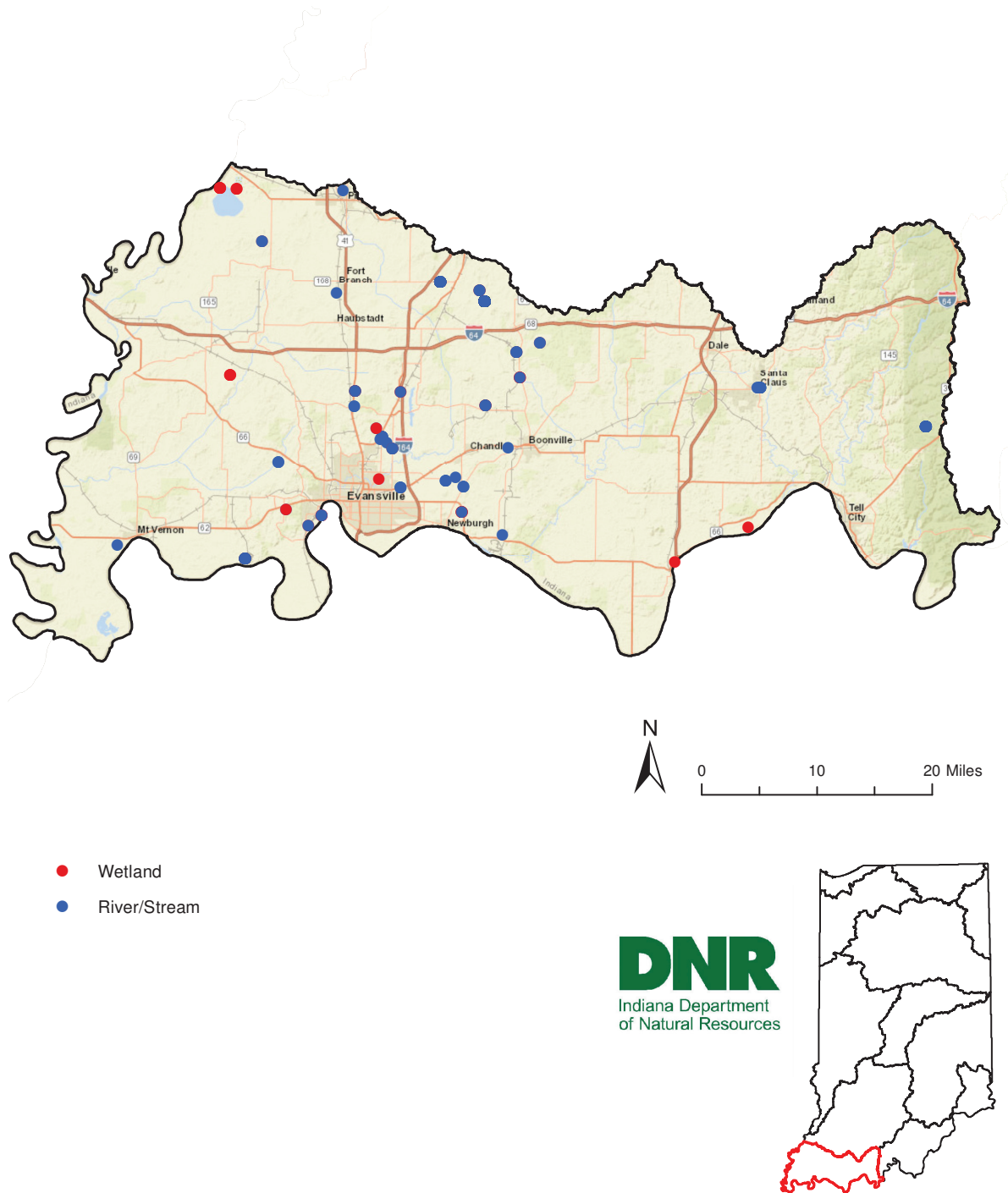


Figure 126. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

## 2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Ohio-Wabash Lowlands SA is presented in **Figure 127** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

### Ohio-Wabash Service Area 2011 Land Cover

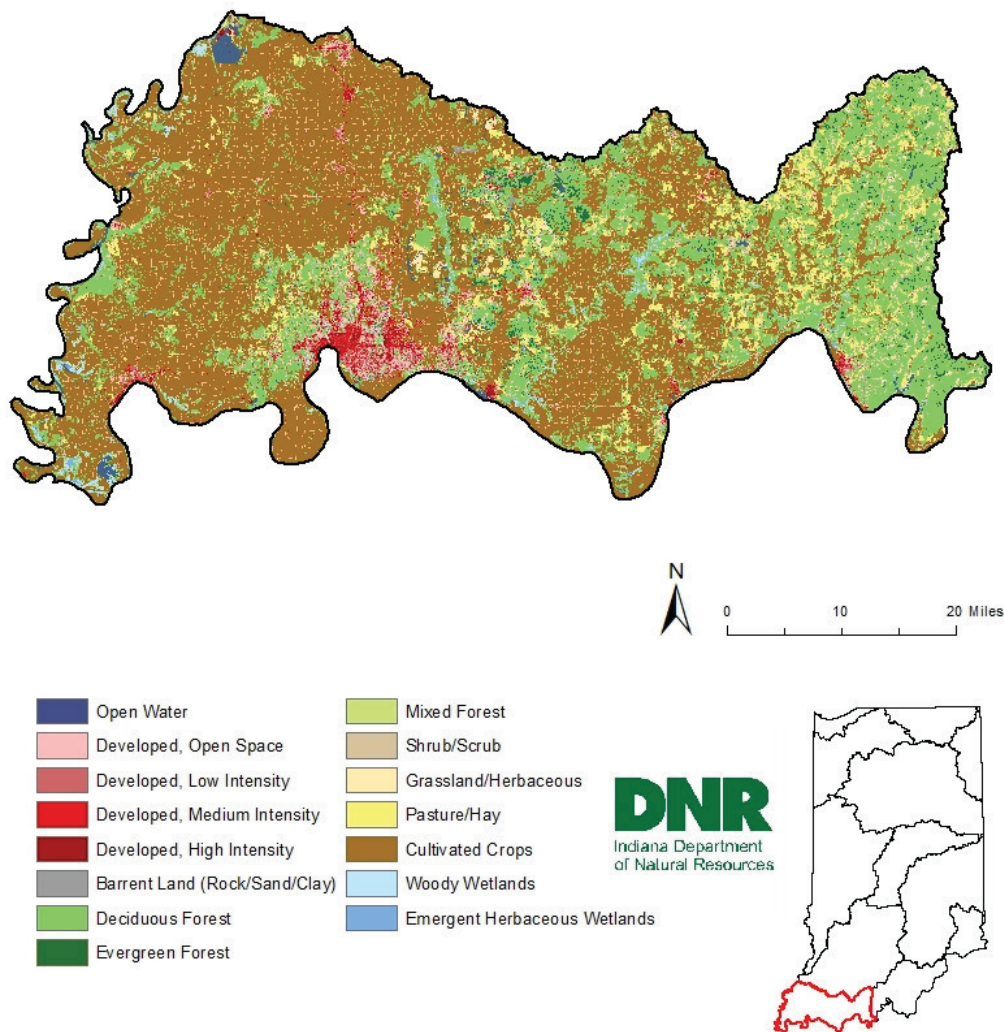


Figure 127. Land cover within the Upper Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification (**Table 109**).

<b>Land Cover</b>			
<b>Class</b>	<b>Value</b>	<b>Sum of Acres</b>	<b>Percent of Total Acres</b>
Open Water	*	27,276	2.03%
Developed	Open Space	88,310	6.57%
Developed	Low Intensity	29,117	2.17%
Developed	Medium Intensity	12,902	0.96%
Developed	High Intensity	6,049	0.45%
Barren Land (Rock/Sand Clay)	*	1,864	0.14%
Forest	Deciduous	380,892	28.33%
Forest	Evergreen	16,906	1.26%
Forest	Mixed	298	0.02%
Shrub/Scrub	*	784	0.06%
Grassland/Herbaceous	*	16,462	1.22%
Pasture/Hay (Agriculture)	*	83,025	6.18%
Cultivated Crops (Agriculture)	*	654,711	48.70%
Wetlands	Woody	20,519	1.53%
Wetlands	Emergent Herbaceous	5,264	0.39%
<b>Grand Total</b>		<b>1,344,382</b>	<b>100.00%</b>

Table 109. Ohio-Wabash Lowlands SA land cover classification/value percentages from 2011 National Land Cover Database  
 \* Class does not have additional values. (Homer, et al., 2015)

IDNR combined the values within the same land cover classification in **Figure 128** below to demonstrate the current overall land cover distribution of the SA.

## Ohio-Wabash Lowlands Service Area Combined Land Use (Acres)

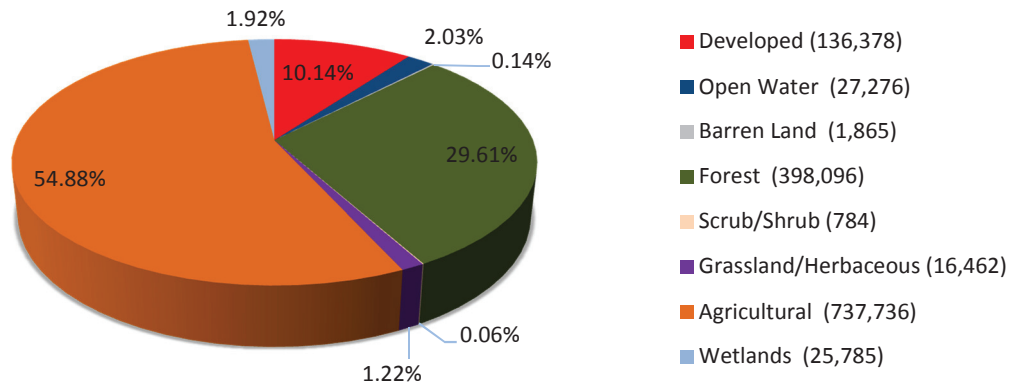


Figure 128. Combined land uses within the Ohio-Wabash Lowlands Service Area from the 2011 NLCD (Homer, et al., 2015)

### **2.3 Agricultural Land Use**

Agricultural land use is the largest land use in the SA. Total agricultural land use covers approximately 55 percent of the SA's total land area of 737,736 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of developed areas such as Evansville and Mt. Vernon and the predominantly forested region along the eastern boundary of the SA.

Within the identified land use areas, cultivated crops cover over 654,711 acres (48.7%) and pasture/hay lands cover 83,025 acres (6.18%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop followed closely by soybeans based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Ohio-Wabash Lowlands SA (USDA-NASS, 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. The Ohio-Wabash Lowlands SA is the eighth largest SA with approximately 1,344,382 acres and contains pork, turkey, and chicken confined feeding operations (CFOs) having at least 5,000 animal units. When combining these major agricultural land use activities, the Ohio-Wabash Lowlands SA ranks seventh in percentage of total statewide land use (3.19%), and is a significant land use within the SA.

### **2.4 Growth and Development**

Developed impervious area is the third largest land use category after forested cover in the SA covering approximately 136,378 acres (10.14%) of the 1,344,382 total acres and is fifth in developed area intensity among all SAs.

In general, the most densely developed areas consist of communities along the Ohio River and along major transportation routes such as U.S. 41 and U.S. 231. The most densely developed communities include Evansville, Newburgh, Mount Vernon, Princeton and Tell City. The SA contains the Evansville MSA, the sixth most populous MSA in the state (Manns, 2013). Approximately 99% (664,698 acres) of the Evansville MSA is located within the SA accounting for approximately 23% of total SA acres. Analysis of the INDOT cities and towns GIS data shows the SA contains all or part of 130 cities and/or towns, 30 of which are incorporated (INDOT, 2016).

Two Indiana regional councils that overlap the SA include the Economic Development Coalition of Southwest Indiana (65%) and the Indiana 15 Regional Planning Commission (35%) (IARC, 2017). According to the Economic Development Coalition of Southwest Indiana, major industries include bio and life science, advanced manufacturing, advanced logistics, energy, coal mining, agriculture, forestry, transportation, warehousing, distribution, retailing, health care, finance, and business services, with southwest Indiana containing many corporate headquarters. Southwest Indiana provides business with access to five MSA's within 3.5 hours all with a population of over one million. More workers commute into the region than workers commute out, resulting in an economic development strategy focusing on improving housing, education, and public works initiatives to make the region more desirable to live and work within (Economic Development Coalition of Southwest IN, 2010).

Southwest Indiana contains several interstates, as well as U.S. and state highways that include the new construction of Interstate 69 bringing improved and more efficient access to the region. In addition to readily available rail access throughout, southwest Indiana is bordered by the Wabash and Ohio Rivers (Economic Development Coalition of Southwest IN, 2010).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 5,873 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The SA has the fifth highest local road miles to square mile ratio of the SA at approximately 2.8 miles of local roads per square mile.

## **2.5 Transportation and Service Corridors**

### **2.5.1 Roads**

The SA contains approximately 555 miles of U.S. Interstates and highways, 1,627 miles of state highways, and 5,837 miles of local roads within its boundary (INDOT Road Inventory Section, 2016). Although this is the eighth largest SA, the concentration of the various road types per square mile of land has varying distribution throughout its boundary.

U.S. Interstates and highways have a concentration of approximately 0.26 mile per square mile, which ranks ninth among the eleven SAs making this the lowest ranking road type within the SA. Although the concentration of U.S. Interstates and highways has the lowest ranking, the concentration of state highways ranks second with 0.77 mile per square mile and is the highest ranking road type within the



Ohio-Wabash Lowlands SA. The ranking of the concentration of local roads ranks near the middle with approximately 2.80 miles per square mile, which ranks fifth when compared to local roads rankings for the ten other SA. Similarly, the combined ranking of the concentration for all roadways ranks near the middle with a concentration of 3.83 miles per square mile, which ranks fifth overall.

Although the concentration of U.S. Interstates and highways ranks near the bottom, closer analysis reveals the concentration of the state highways places near the top, while local roads and the ranking of all roads combined ranks near the middle when compared to all the other SAs. The construction and maintenance of roads and bridges, throughout the Ohio-Wabash Lowlands SA supports the predominant mode of transportation and plays an integral role in sustaining business and commerce for the region.

#### 2.5.2 Railroads

As an alternative mode of transportation, the Ohio-Wabash Lowlands SA has approximately 407 miles of railroad within the SA boundary (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Ohio-Wabash Lowlands SA contains the eighth largest concentration of railroads with a density of 0.19 mile per square mile. The concentration of linear infrastructure throughout the SA contributes to aquatic resource threats including habitat fragmentation, disruption to fluvial processes, resource degradation, conversion and loss of aquatic resources.

#### 2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Ohio-Wabash Lowlands SA contains service corridors, which contribute to aquatic resource impacts and habitat loss. The SA contains over 3,146 miles of service corridors.

The Ohio-Wabash Lowlands SA contains an extensive network of large kilovolt (kV) electric transmission lines. The large kV transmission lines identified within the SA include approximately 332 (12 kV) lines, thirteen (69 kV) lines, four (138 kV) lines, eighteen (345 kV) lines, and twelve (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 1,046 miles throughout the SA, which is tied with the St. Joseph River SA for the fourth highest concentration of electric transmission lines relative to the SA size with 0.5 mile of transmission line per square mile.

In addition to electric transmission lines, the SA contains over 2,100 miles of pipelines. This includes over 543 miles of pipelines that convey crude oil, 417 miles of pipelines that transport natural gas, and 124 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Ohio-Wabash Lowlands SA contains the greatest concentration of crude oil pipelines and the eighth greatest concentration of natural gas and refined petroleum product pipelines.



## **2.6 Dams and Non-Levee Embankments**

There are currently no known low head dams (IDNR DOW, 2016) within the SA. There are currently 55 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 38 square miles; tied for the fourth highest concentration across all SAs, containing 6% of documented high head dams statewide.

According to NLE GIS analysis (IDNR, 2016), there are approximately 1,953,600 linear feet (370 miles) of NLE's mapped within the SA, averaging one mile of NLE per 6 square miles, the highest concentration among all SAs. Approximately 275 miles of the NLEs are located within predominantly developed areas with the remaining 95 miles mapped in rural agricultural settings.

## **2.7 Energy Production and Mining Threats**

### **2.7.1 Coal**

The Ohio-Wabash Lowlands SA contains historic and active coal mining operations. Based upon IDNR-Division of Reclamation's (DOR) surface and underground coal mining dataset, coal mining operations were first documented in 1858 and have effected over 128,584 acres (Gray, Ault, Keller, & Harper, Surface Coal Mines in Indiana, 2010); (Gray, Ault, Keller, & Harper, Underground Coal Mines in Indiana, 2010).

Mining operations, prior to the enactment of the SMRCA of 1977, were not required to implement post mining reclamation. The Ohio-Wabash Lowlands SA contained approximately 330 surface coal mines totaling approximately 58,453 acres, and 382 underground coal mines totaling 24,923 acres of Pre-SMCRA coal mining operations. These Pre-SMCRA surface mining operations impacted 4.35% of the SA land cover, which ranks first of the three coal bearing SAs. Pre-SMRCA underground mining operations impacted 1.85% of the SA land cover ranking it second of the three.

Surface and underground mining operations that fall under regulation of the SMRCA of 1977 are prevalent throughout the SA. The IDNR DOR has recorded over 314 surface coal mining operations totaling approximately 37,837 acres and over 27 underground mining operations that total approximately 7,370 acres within the SA. These surface mining operations impact over 2.81% of the SA land cover which ranks it second among the SAs. Similarly, the concentration of underground mining operations ranks second with 0.55% SA land cover concentration. This SA is the smallest of the three that contains coal with approximately 1,344,382 acres. Surface mining has resulted in impacts to approximately 96,291 acres altering over 7.16% of the SA's land cover ranking it first. Underground mining impacts have altered over 32,293 acres of the SA ranking it second with a concentration of 2.4% of the SA land cover.

### **2.7.2 Natural Gas and Oil Production**

The Ohio-Wabash Lowlands SA contains a multitude of active oil and gas fields along with wells that currently support, or have supported, the petroleum industry. The Indiana Geological Survey (IGS)

identifies 24 petroleum gas fields with 89 associated gas wells; 166 oil fields with 2,705 oil wells; and 51 oil & gas fields with two oil & gas wells ranking the SA first statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 158 abandoned gas wells, 4,209 abandoned oil wells, 22 abandoned oil & gas wells, 10,104 dry wells, six observation wells, 309 stratigraphic wells, 82 saltwater disposal wells, 137 abandon saltwater disposal wells, 180 temporarily abandoned wells, one potable water supply wells, 38 non-potable water supply wells, 837 water injection wells, 103 gas storage, two abandoned gas storage, one abandoned observation wells, two abandoned waste disposal wells, 587 abandoned water injection wells, 963 abandoned oil and water injection wells, one abandoned oil, gas and water injection well, and three waste disposal wells within the SA (Indiana Geological Survey, 2015).

### 2.7.3 Mineral Mining and Aggregates

The Ohio-Wabash Lowlands SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains five active sand & gravel mining operations ranking it last in the state (Indiana Geological Survey, 2016).

## **2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats**

The Ohio-Wabash Lowlands SA partially contains the Indiana SWAP Valleys and Hills Planning Region (83.4%) and a smaller portion of the Interior Plateau Planning Region (16.6%). The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

## **2.9 Anticipated Threats**

The existing land uses within the agricultural and developed impervious footprints make up approximately 65% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects energy production and mining, specifically surface coal mining, to remain the foremost permitted activities requiring mitigation for aquatic resource impacts followed by development and transportation projects if the 404 permitting trends of the past 7 years continue.

Evansville is the third-largest city in Indiana and the largest in Southern Indiana. Evansville is the regional economic hub for the Illinois-Indiana-Kentucky Tri-State Area, a 24-county economic region with 822,000 residents. The population throughout southwest Indiana is projected to grow by approximately 5% through 2040 (Economic Development Coalition of Southwest IN, 2010).

Infrastructure maintenance and improvements are not keeping pace with the region's growth, and although there are significant transportation and logistics assets, economic development strategies call for increased and improved connectivity to increase efficiency between all modes of travel and transport (Economic Development Coalition of Southwest IN, 2010).

Through the comprehensive economic development process, southwest Indiana community representatives from all sectors have identified business development, urban/downtown revitalization, energy, facilities, housing, parks, road/transportation upgrades, water supply, waste and storm water system improvements, communication infrastructure, and energy production as top growth objectives (Economic Development Coalition of Southwest IN, 2010).

Abandoned mines will continue to negatively impact the chemical, physical and biological integrity of aquatic resources. Among the many impacts to aquatic resource functions and services in the SA, invasive species will continue to thrive unless restoration and enhancement efforts are increased and ongoing long term management is actively conducted.

Forests cover approximately 30% of the SA, so forest conversion (deforestation) and timber harvesting have the potential to impact aquatic resources; though modern selective timber harvesting practices have moderated the industry's threats to, and impacts upon, aquatic resources.

## **2.10 Offsets to Threats**

IDNR will apply the same restoration, enhancement and/or preservation approaches to offsetting the predominant threats in the Ohio-Wabash Lowlands SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

### **ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS**

The Ohio-Wabash Lowlands SA's historic aquatic resources and landscape were shaped by the large rivers and associated forested bottomlands of the Wabash and Ohio Rivers. The extensive river bottom lowlands of this SA were known to possess significant forested wetland communities. Many small streams throughout the eastern region are comprised of short drainages directly into the Ohio River. The streams of the western portion of the SA are comprised of longer reaches extending across the region before their confluence with the Wabash and Ohio Rivers. The composition of the SA's aquatic resources were shaped by this floodplain landscape. These aquatic resources were altered resulting in degradation and loss by the region's early settlers.

The SA's aquatic resources experienced this degradation and loss due to agricultural land use conversion throughout the SA. During the 1800s, settlers rapidly changed the landscape by clearing the forests for agriculture, allowing livestock to roam free, draining wetlands, ultimately impacting the native vegetation and natural communities (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012). In order to facilitate agriculture within this SA, European settlers' channelized first and second order streams to facilitate drainage for crops, which increased nutrients and other pollutants into the streams for over two centuries (Pigeon-Highland Watershed Steering Committee and Four Rivers Resource Conservation & Development Area, Inc., 2003). In addition to using pasture lands to raise cattle and hogs, growing wheat, corn, rice, cotton and tobacco; large settlements, such as Harmony and Vincennes contained horses and sheep during the early 1800s (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012). By 1816, the first and second bottoms of the Wabash River, near New Harmony, contained 700-800 acres of fenced cropland (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012).

As the SA received more settlers, the natural communities of the region felt increased pressures. The City of Evansville and the county in which it resides were established in the early 1800s. Similar to the establishment of other upstream cities, Evansville was situated along the Ohio River. Being situated along an important trade route, business and commerce were important regional growth here. By the late 1800s the increased demand for construction lumber, coal, natural gas, and oil was fueled by the construction of new factories and homes (Carman, 2013). During the end of this period, Evansville had become a center for furniture manufacturing and contained over 300 iron, steel and woodworking companies (Pigeon-Highland Watershed Steering Committee and Four Rivers Resource Conservation & Development Area, Inc., 2003).

The SA contains the southernmost region of the Illinois basin coal field. The existence of coal throughout the region has played a major role in the transformation of the landscape for centuries. Since the first discovery of coal along the Wabash River in 1736, the use of coal provided settlers with an energy source for survival. Indiana coal mining began in the 1830s, with its predominant uses as fuel for Ohio River steam boats, heating, and blacksmith forges (Stevens, 2012). Recovered coal was

shipped throughout the region by utilizing the region's waterways. In 1840, flat boats were being used to ship small quantities of coal from locations along the Ohio, Wabash and White Rivers (Stevens, 2012). During this period, coal mining communities began to develop in order to support the coal mines. In 1850, the first underground mine shaft for deep vein coal mining was constructed in Newburgh, Indiana (Town of Newburgh Indiana, 2017). Less than ten miles to the north, the Chandler Mine was opened in 1875 becoming the town of Chandler's first underground mine (Town of Chandler Indiana, 2017). Coal mining within the SA, became the primary fuel for locomotives and energy production resulting in an influx of companies and mining operations into the town (Town of Chandler Indiana, 2017).

Mineral extraction and massive landscape alteration within the SA have resulted in over two centuries of ecosystem structural and functional damage which limits its ability to recover (Pigeon-Highland Watershed Steering Committee and Four Rivers Resource Conservation & Development Area, Inc., 2003). This resulted in degradation and loss of streams and wetlands. Environmental consequences from historical mining practices were severe and prolonged due to the high demand for coal, lack of regulations, and the absence of methods for successful land reclamation (Stevens, 2012).

Industry and commerce played an important role in the history of aquatic resource loss throughout the SA; however, transportation provided the means for sustaining the region's growth by providing avenues to get commodities to market. By the mid-1880s, Newburgh's Ohio River port grew to become the largest river port between Cincinnati and New Orleans (Town of Newburgh Indiana, 2017). Canals were constructed in order to provide a means of transport but they were slowly replaced by railroads during this period. The Lake Erie, Evansville & South Western Railroad was completed within the SA by 1873; constructed along the creek bed of the failed Central Canal in order to provide a rail line from Evansville to Gentryville (Town of Chandler Indiana, 2017).

Due to extensive aquatic resource loss within the Ohio-Wabash Lowlands SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 129** depicts each Natural Region and Section located within the Ohio-Wabash Lowlands SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss (**Table 110**). The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

## Ohio-Wabash Lowlands Service Area Natural Regions and Sections

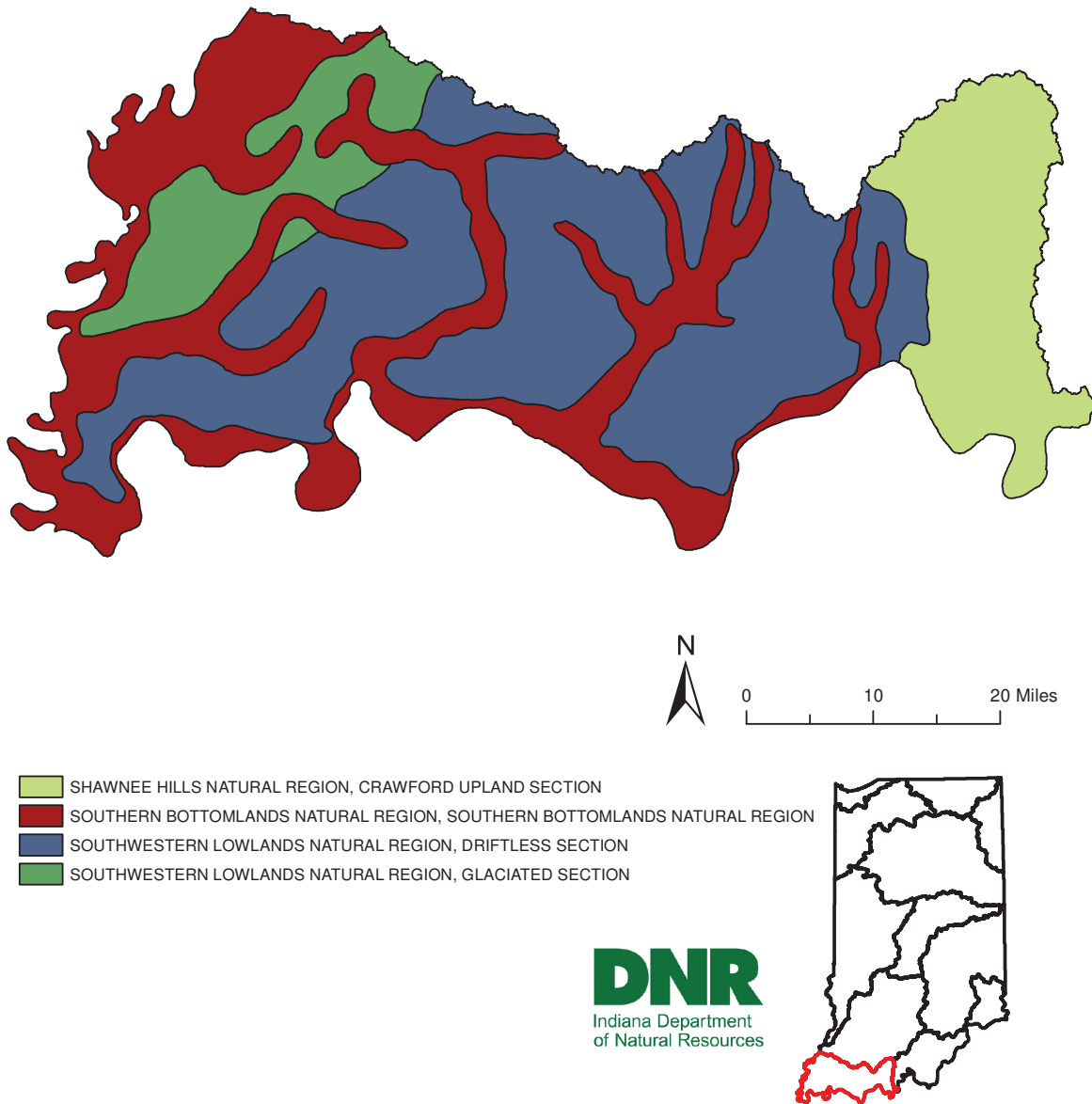


Figure 129. Natural regions and sections within the Ohio-Wabash Lowlands Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Shawnee Hills	Crawford Upland	15.08	Upland forest types, few sandstone and limestone glades, gravel washes, and barrens; acid seep spring community (rare)	182,369	13.57	36	0.001	99.77
Southern Bottomlands	Southern Bottomlands	33.84	Bottomland forest, swamp, pond, slough, and formerly marsh and prairie					
Southwestern Lowlands	Driftless	42.11	Predominantly upland forest, southern flatwoods, barrens (xeric, ephemeral wet), acid seep spring (rare), marsh, swamp, sandstone cliff; low to medium-gradient stream					
	Glaciated	8.97	Predominantly forested, flatwoods, prairie (several), swamp, marsh, pond; low-gradient streams					

Table 110. The historic natural community composition for the Upper White Service Area based upon the natural region and section

## ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

### 4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are 488 miles of category 4A impaired streams and 997 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (398 miles), impaired biotic communities (294 miles), dissolved oxygen (122 miles), PCBs in fish tissue (121 miles), pH (37 miles), nutrients (10 miles), pesticides (5 miles), total mercury in fish tissue (5 miles), and chloride (4 miles) as existing stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 126 QHEI assessment reaches within the SA (**Table 111 and Figure 130**) (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, only 11.9% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	66	52.38
51-64	Habitat is partially supportive of a stream's aquatic life design	45	35.71
>64	Habitat is capable of supporting a balanced warm water community	15	11.90
Total		126	100%

Table 111. IDEM Overall QHEI scores for Ohio-Wabash Lowlands SA, 1991 – 2014 (IDEM OWQ, 2014)



## Ohio-Wabash Lowlands Service Area Qualitative Habitat Evaluation Index (QHEI) Scores

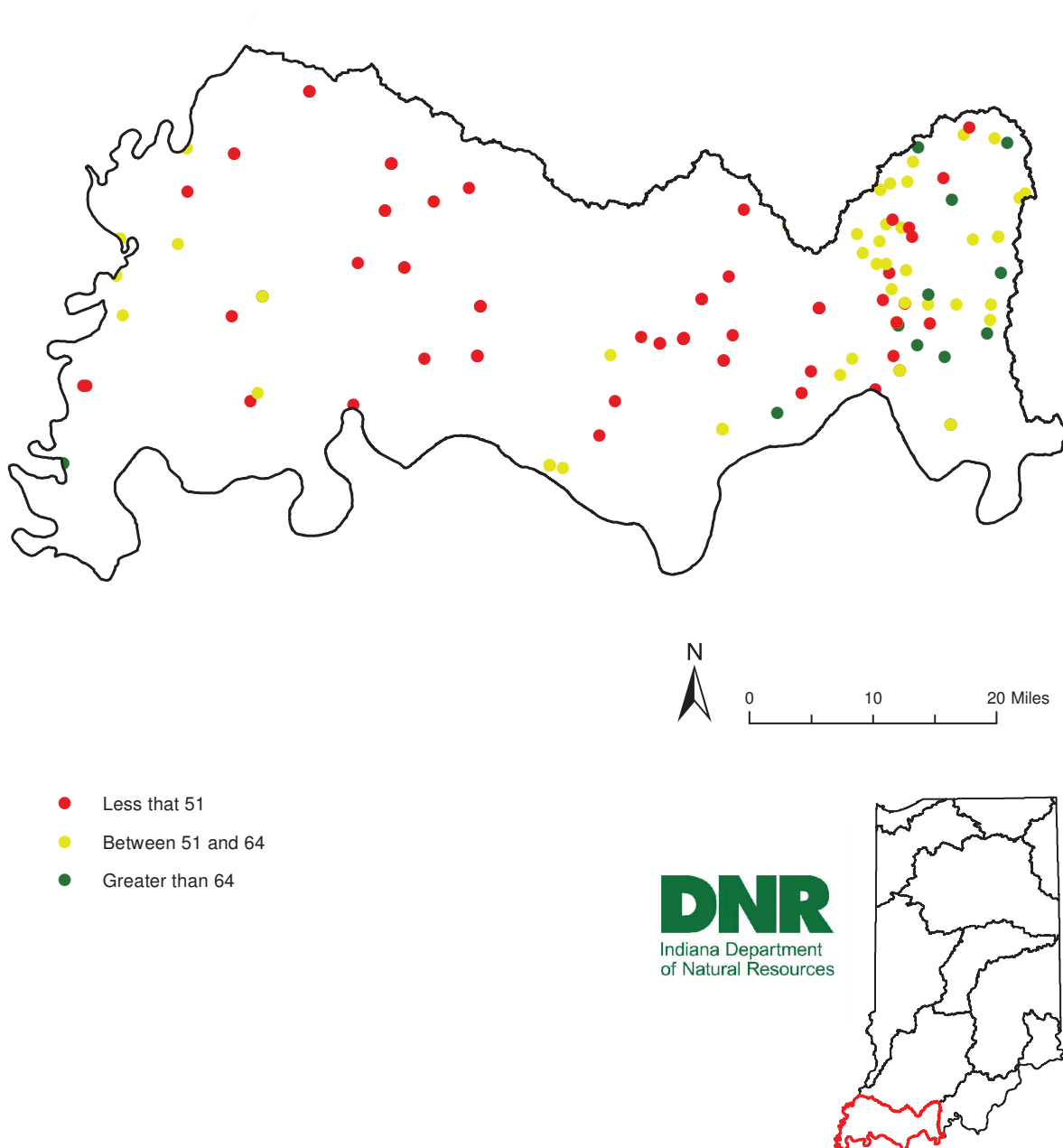


Figure 130. IDEM overall QHEI scores within the Ohio-Wabash Lowlands service area; 1991-2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Ohio-Wabash Lowlands SA ranks third overall in forested cover density of all SA's at 30% of total area with approximately 218,061 acres, and contains the third most forested cover of any SA at approximately 7.63% of 5,215,169 acres of forest cover statewide.

GIS analysis identified approximately 7,675,720 linear feet (1,454 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Ohio-Wabash Lowlands SA has the highest ratio of restorable stream miles to square miles of SA at approximately 0.69 mile of potential restoration per one square mile, or one mile of potential restoration for every 1.45 square miles of SA.

#### **4.2 Wetlands**

Analysis of the NWI in the Ohio-Wabash Lowlands SA identifies approximately 8,936 acres of freshwater emergent wetland (PEM) and approximately 53,443 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 4.64% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 19.35% of the total SA (**Table 112 and Figure 131**).

<b>Aquatic Resource Type</b>	<b>Sum of NWI Aquatic Resource ACRES in SA</b>	<b>Percent of Total NWI Aquatic Resource Acres in SA</b>	<b>Percent of SA Total Acres</b>	<b>Percent of Total State Area –Acres</b>
<b>Freshwater Emergent Wetland</b>	8,936	3.44%	0.66%	0.04%
<b>Freshwater Forested/Shrub Wetland</b>	53,443	20.55%	3.97%	0.23%
<b>Freshwater Pond</b>	15,795	6.07%	1.17%	0.07%
<b>Lake</b>	134,038	51.54%	9.97%	0.58%
<b>Riverine</b>	47,857	18.40%	3.56%	0.21%
<b>Grand Total</b>	<b>260,070</b>	<b>100.00%</b>	<b>19.35%</b>	<b>1.12%</b>

**Table 112. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)**

Hydric and partially hydric soils account for 134,284 acres (**Figure 132**), or 10% land cover within the SA, out of which approximately 81,387 acres have the potential to be restored, accounting for 6.05% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The SA has the fourth least percentage of recoverable wetland acres to total SA size of all SAs and the third least amount of potentially restorable wetland acres of any SA.

## Ohio-Wabash Service Area National Wetlands Inventory

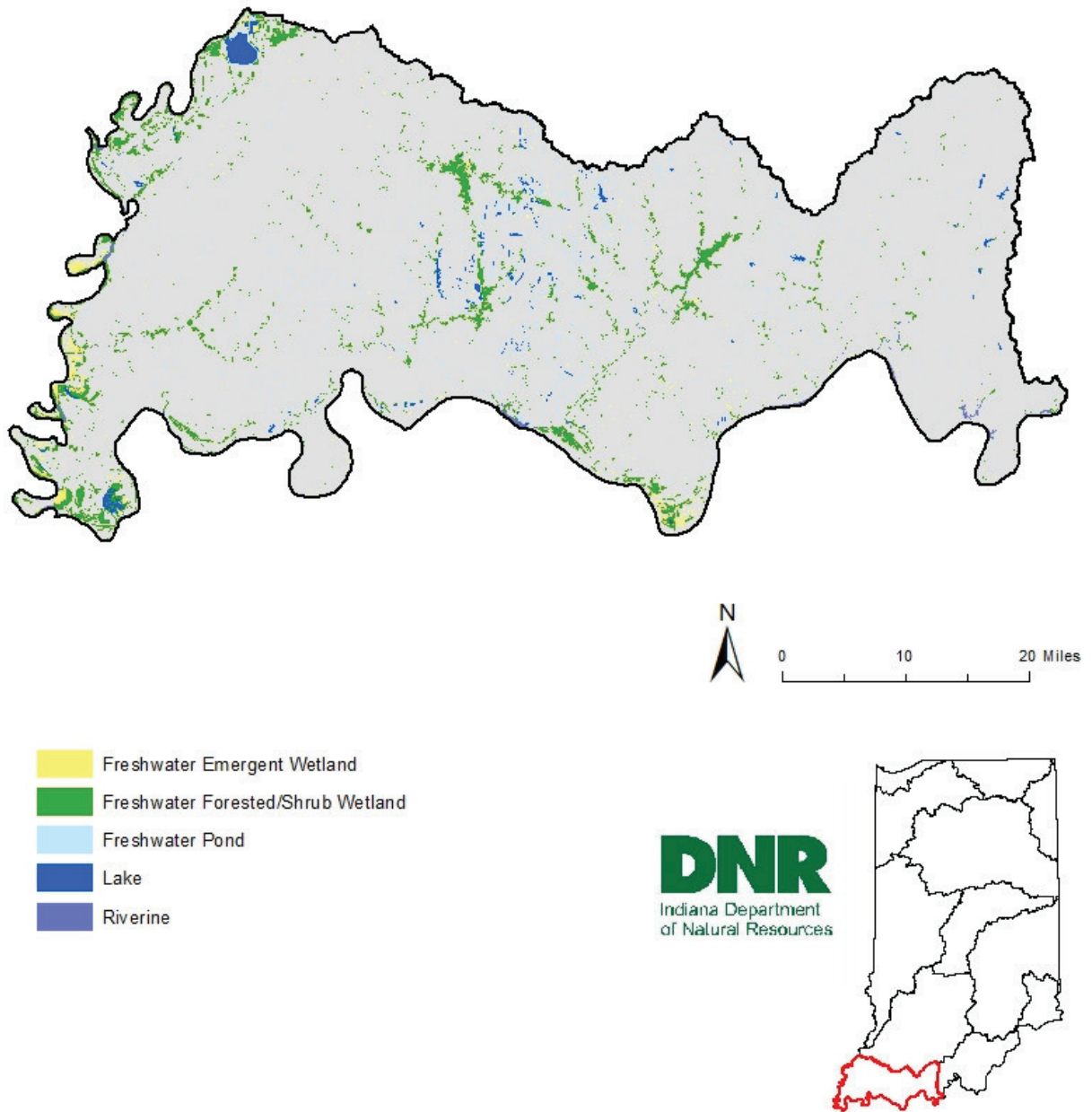


Figure 131. NWI for the Ohio-Wabash Lowlands Service Area (USFWS NWI, 2015)

## Ohio-Wabash Lowlands Service Area Hydric Soils

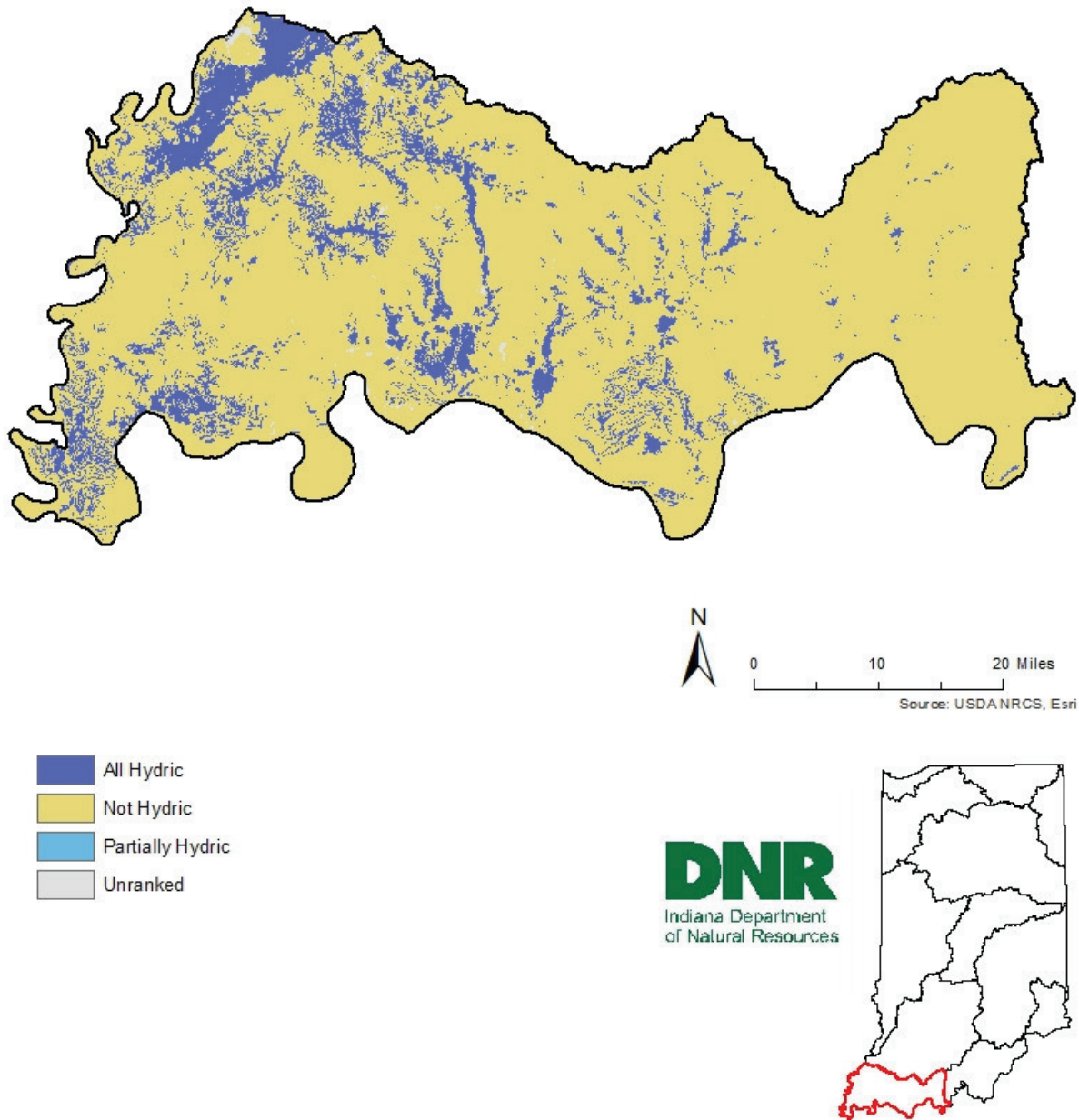


Figure 132. Hydric and partially hydric soils within the Ohio-Wabash Lowlands Service Area (NRCS-USDA, 2016)

#### **4.4 Concentrations of Potentially Restorable Wetlands and Streams**

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 73,466 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Scott Ditch-Wabash River (HUC 051201130305 [Table 113]).

Hotspots account for 2,222,880 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Pond Flat Ditch (HUC 051201130701 [Table 114]). The watersheds with the highest concentrations of potentially restorable wetlands and streams (Tables 113 and 114) serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA and displayed in Figure 133.

Approximately 1,478 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands. Bluegrass Fish and Wildlife Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable wetlands (1,056 acres). Approximately 3,865 linear feet of hotspots of potentially restorable stream are on IDNR-managed lands. Approximately 5,370 linear feet of hotspots of potentially restorable stream are adjacent to IDNR-managed lands. Bloomfield Barrens Managed Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable streams (3,131 linear feet).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
051201130305	Scott Ditch-Wabash River	8,973
051201130502	Headwaters Black River	6,480
051201130302	McCarty Ditch-Coffee Bayou	5,491
051201130501	Barren Creek-Higginbotham Ditch	5,029
051402020103	West Fork Creek	4,459

**Table 113. Watersheds in the Ohio-Wabash Lowlands Service Area with the most hotspots of potentially restorable wetlands**

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
051201130701	Pond Flat Ditch	126,720
051201130703	Caney Creek-Big Creek	119,328
051402020103	West Fork Creek	76,032
051402020603	Cypress Slough	64,944
051201130702	Neuman Lateral-Big Creek	64,944

**Table 114. Watersheds in the Ohio-Wabash Lowlands Service Area with the most hotspots of potentially restorable streams**

# Ohio-Wabash Lowlands Service Area

## Concentrations of Potentially Restorable Streams and Wetlands

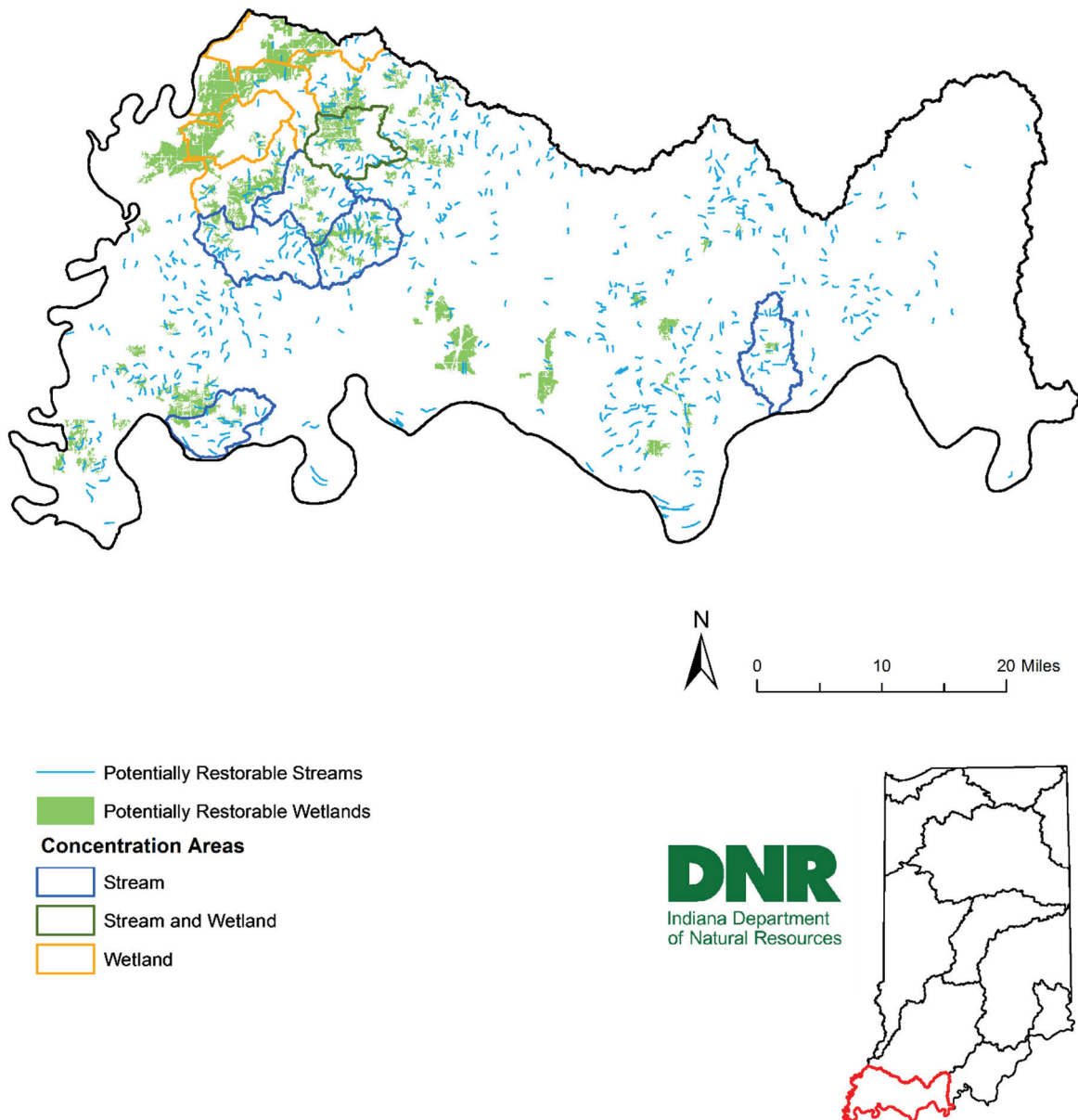


Figure 133. Concentrations of Potentially Restorable Streams and Wetlands in the Ohio-Wabash Lowlands Service Area



#### 4.4 Lakes, Reservoirs, and Ponds

GIS analysis of 303(d) lake impairments in the Ohio-Wabash Lowlands SA identified three lakes currently documented having the category 5 impairments, which measured using the National Hydrography Dataset (NHD), accounts for approximately 1,390 acres for PCBs in fish tissue, and 37.3 acres for taste and odor (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 27,276 acres of open water which accounts for 2% of the SA. This varies slightly from the NWI, which identifies approximately 15,795 acres of freshwater ponds comprising of 1.2% of the SA, and 11,368 acres of lake comprising of 0.85% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Ohio-Wabash Lowlands SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

#### 4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Ohio-Wabash Lowlands SA shows that approximately 95% of the shallow unconsolidated aquifers receive seven or less inches of ground water recharge annually (**Table 115**).


Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
	14	8	0.40%
	13	29	1.37%
	12	21	1.01%
	11	14	0.68%
	10	8	0.37%
	9	5	0.25%
	8	15	0.74%
	7	22	1.05%
	6	65	3.11%
	5	305	14.61%
	4	576	27.61%
	3	661	31.71%
	2	264	12.64%
	1	92	4.43%

Table 115. Approximate ground water recharge rates in the Ohio-Wabash Lowlands SA (Letsinger S. L., 2015)



Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that approximately 91% of the Ohio-Wabash Lowlands SA near surface aquifers are in the moderate to low range for sensitivity to contamination (**Table 116**). The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	81	3.87%
High	93	4.45%
Moderate	704	33.74%
Low	1,197	57.37%
Very Low	12	0.56%

Table 116. Ground water sensitivity distribution in the Ohio-Wabash Lowlands Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Ohio-Wabash Lowlands SA as the fourth most registered capacity of surface water withdrawal among SAs with a 2015 withdrawal capacity of 262,061 MGD (**Figure 134**) (IDNR DOW, 2016). Industrial uses account for approximately 66% of registered surface water withdrawal capacity, followed by energy production at 30%, and public water supply at 4%.

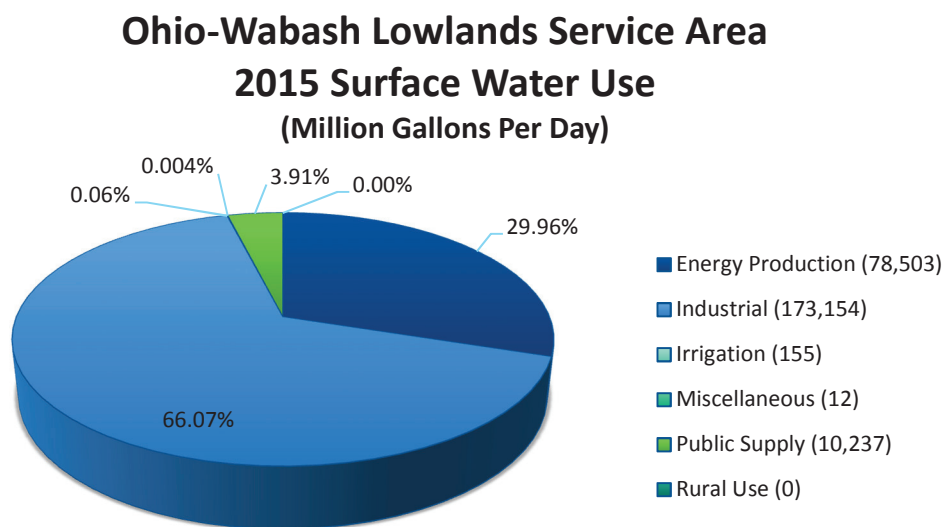


Figure 134. 2015 surface water usage in the Ohio-Wabash Lowlands Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Ohio-Wabash Lowlands SA is the third least among SAs with an 8,131 MGD registered withdrawal capacity (**Figure 135**). Public water supply accounts for approximately 31% of registered ground water withdrawal capacity in the SA, followed by energy production with 30%, industrial uses with 8%, and agricultural irrigation accounting for the remainder.

### Ohio-Wabash Lowlands Service Area 2015 Groundwater Use (Million Gallons Per Day)

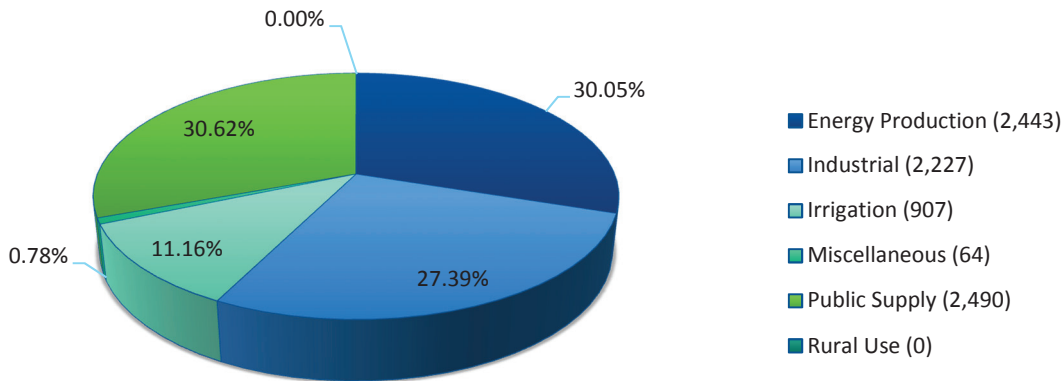


Figure 135. 2015 groundwater usage in the Ohio-Wabash Lowlands Service Area (IDNR DOW, 2016)

#### **4.6 High Quality Aquatic Resources and Natural Communities**

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Ohio-Wabash Lowlands SA include, but are not limited to, forested swamp, shrub swamp, and wet floodplain forest, in addition to many other mixed or upland communities.

There are currently a minimum of seven amphibian species, 46 bird species, 10 fish species, 17 mammal species, nine mollusk species, and 11 reptile species listed as SGCN within the SWAP Planning Regions within the Ohio-Wabash Lowlands SA (SWAP, 2015).

Multiple areas of the Ohio-Wabash Lowlands SA were recognized as focus areas for migration habitat; these areas included the westernmost counties of the SA, Gibson and Posey counties, as well as the Little Pigeon Creek. Gibson Lake and its adjacent wetlands are heavily used during fall and spring migration by waterfowl and various shorebirds and wading birds. Posey County contains numerous oxbow lakes, broad lowlands, and bottomland hardwood forests which are utilized by wood ducks as nesting habitat and is greatly used by migrating waterfowl during spring and fall. Its close proximity to the Ohio River allows large areas of Posey County to be flooded during late winter and spring; these areas provide some of the most productive shorebird habitat in Indiana. The Little Pigeon Creek serves as a valuable nesting habitat for wood ducks and also as important migratory habitat for waterfowl (UMGL JV, 1998).

## **ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES**

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Ohio-Wabash Lowlands SA. The following aquatic resource goals and objectives apply specifically to the Ohio-Wabash Lowlands SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources that will offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.
7. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Interior River Valleys and Hills, and Interior Plateau Planning Region where feasible.
8. Stream and wetland restoration projects to buffer and protect karst features and systems unique to areas in southern Indiana.
9. Support efforts to offset aquatic resource degradation associated with historic mining activities throughout the service area.

## **ELEMENT 6. PRIORITIZATION STRATEGY**

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA.

When prioritizing sites for mitigation projects, the following core criteria shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Ohio-Wabash Lowlands SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Big Creek WMP, Highland-Pigeon WMP, Pitcher Lake WMP, and Upper Anderson River WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

## **ELEMENT 7. PRESERVATION OBJECTIVES**

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Ohio-Wabash Lowlands SA will permanently protect rare aquatic habitats, include high quality natural aquatic and riparian communities, and waters having a significant contribution to ecological sustainability and important critical habitat for SGCN, while addressing the important physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in coincidence/conjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

## **ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT**

Currently, the following land trusts exist within the SA: Four River RC&D and Sycamore Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Ohio-Wabash Lowlands SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Kentucky Water Science Center
- USGS Illinois Water Science Center
- U.S. Forest Service Hoosier National Forest
- Ohio River Valley Water Sanitation Commission (ORSANCO)
- Appalachian Landscape Conservation Cooperative
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Economic Development Coalition of Southwest Indiana
- Indiana 15 Regional Planning Commission
- Indiana Karst Conservancy
- The Wabash Border Natural Division- Illinois Natural History Survey (INHS)

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 136** below.

#### **ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT**

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

#### **ELEMENT 10. PERIODIC EVALUATION AND REPORTING**

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

## Ohio - Wabash Lowlands Service Area High Priority Aquatic Resource Conservation Sites

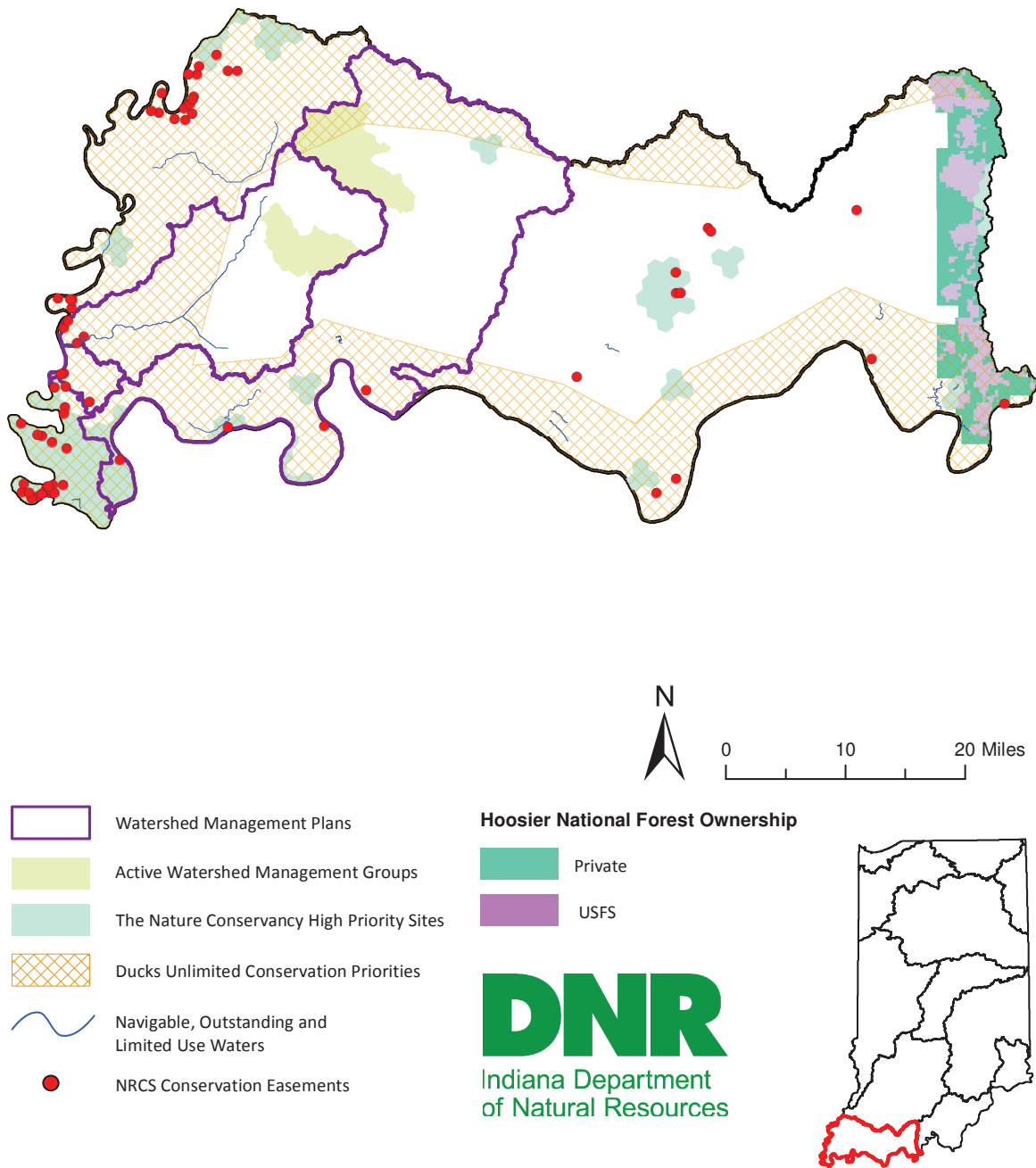


Figure 136. Priority aquatic resource conservation groups and sites within the Ohio-Wabash Lowlands Service Area (IWPP, 2015)